



TRANSICOLD

Marine/Industrial Single Package Cooling Unit

Models

**90MA/MF/MU, Design Series Two
Beginning Serial Number C00400**

**INSTALLATION
& SERVICE**



TRANSICOLD

OPERATION AND SERVICE MANUAL MARINE/INDUSTRIAL SINGLE PACKAGE COOLING UNIT

MODELS 90MA/MF/MU, Design Series Two Beginning Serial Number C00400

Carrier Refrigeration Operations, A member of the United Technologies Corporation family. Stock symbol UTX.
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Carrier

A United Technologies Company

SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers, start-stop switches are turned off, and power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator fan. Do not open the evaporator access panels before turning power off, disconnecting and securing the power source.

Be sure power is turned off before working on motors, controls, solenoid valves and electrical control switches. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

In case of electrical fire, open circuit switch and extinguish with CO₂ (never use water).

SPECIFIC WARNING AND CAUTION STATEMENTS

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

WARNING - means to warn against hazards or unsafe conditions which could result in severe personal injury or death.

CAUTION - means to warn against potential hazard or unsafe practice which could result in product or property damage.

The statements listed below are applicable to the unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

WARNING

Never reach into unit while fan is running. Lock open and tag unit disconnect before working on fan. Remove fuses and take them with you after noting this on tag.

WARNING

Follow all Safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution.

WARNING

Lock open and tag unit disconnect before working on fan motor. Remove fuses and take them with you after noting this on tag.

CAUTION

Compressor crankcase heater must be energized for 24 hours prior to start up to prevent compressor bearing damage.

CAUTION

Sharp edges of coil fins are exposed. To prevent injury, cover top of evaporator with cardboard or a few layers of heavy tape.

CAUTION

To avoid coil damage, cover evaporator face with plywood or other rigid sheet material. If any coil fins are mashed or bent, straighten with a coil fin comb of the proper tooth spacing (refer to “coil fins/inch” in Table 1 through Table 2). Check for refrigerant leaks.

CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

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1. INTRODUCTION

The 90M series single-package cooling units (See Figure 1) are designed to provide air conditioning aboard marine vessels and in industrial applications. The 90MA units are fitted with sea water cooled condensers while the 90MF units are fitted with fresh water cooled condensers. Both units are factory charged, wired and piped. The 90MU units are similar except they are configured for use with a remote mounted condenser.

An accessory discharge plenum may be installed to provide free-blow into the conditioned space. Also, an accessory electric, hot water or steam coil heater may be installed to provide comfort heating.

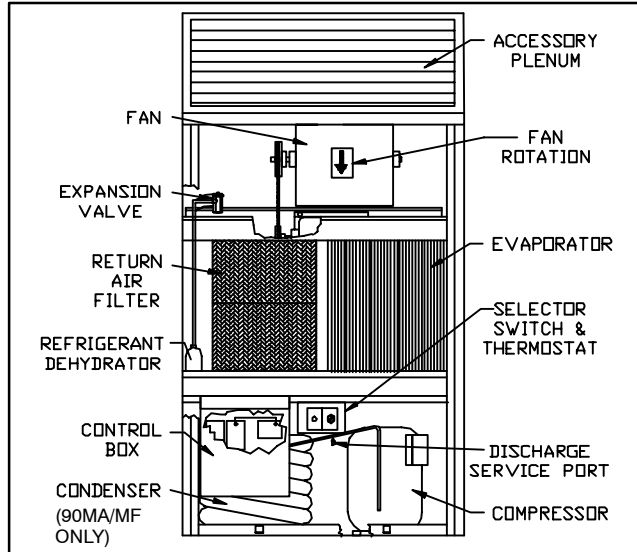
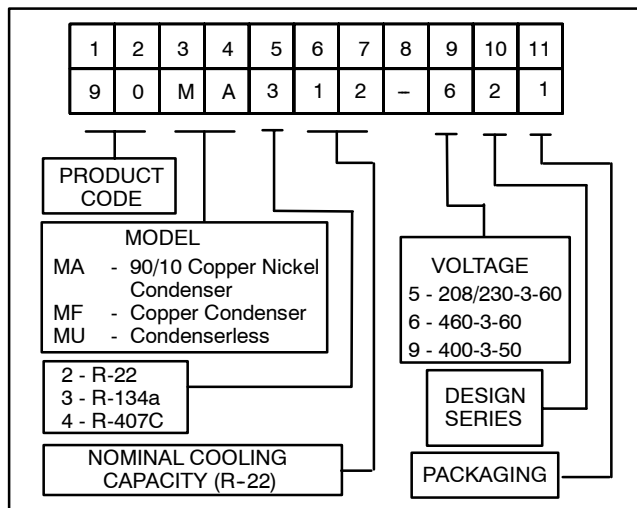


Figure 1 Base Unit Interior Details (Typical)

2. MODEL CHART

This manual covers 90M design series two units as shown in the following model chart.



3. INSTALLATION

To install the unit, do the following:

3.1 Inspect Unit

Check unit against shipping order. Inspect carefully for concealed shipping damage. If shipment is damaged or incomplete, *file claim with transportation company and advise Carrier Transicold immediately.*

3.2 Protect Unit from Damage

To maintain warranty, protect unit against adverse weather, theft, or vandalism on job site.

3.3 Provide Unit Support

Refer to Figure 2 and Table 1 through Table 2 for unit size and weight. If desired, construct a frame of I-beams or angle iron that adequately supports unit. See Figure 12.

3.4 Install Accessory Heating Coil (if applicable)

Electric heaters are installed at the top of the unit. Water or steam coil must be installed through the back of the unit as described in the Installation Instructions shipped with the accessory coil.

3.5 Rig and Place Unit

NOTE

Install accessories before placing unit.

- a. Provide space around unit for service, filter access, and overhead clearance as indicated in Figure 2.
- b. Move and store unit in upright position.
- c. Use slings with spacer under base skid to prevent panel damage when using hoist.
- d. Units as shipped are adequately dampened against vibration. If additional dampening is desired, place sponge rubber or rubber mat, between deck and base of unit or install vibration isolators.
- e. Unit should be level. Unit leveling tolerance is 1/8 inch per linear foot in any direction.

3.6 Install Accessory Plenum (If Supplied)

Use plenum as template to mark hole locations in top panel. Drill 5/32-in. (0.4 cm) holes in top panel at marked locations and attach plenum with screws supplied.

3.7 Install Ventilation-Air Ductwork (If required)

Connect ventilation ducts to flanges on outside-air supply opening (See Figure 2) using a flexible connection. Attach ductwork to ship structure and insulate with fiberglass and vapor barrier to reduce sound transmission and prevent vapor condensation.

Weatherproof external ductwork, joints, and openings in accordance with applicable codes. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

3.8 Install Return Air Ductwork (If required)

The unit back panel is to be field cut for alternate return-air (or outdoor-air inlet) opening as indicated in Figure 2. To install ductwork:

- a. Cut out the alternate return-air opening as required.

Table 1 90MA/MF/MU Physical Data - Refrigerant 22

		R-22 - English Units				R-22 - Metric Units			
BASE UNIT 90MA/MF/MU	UNITS English (Metric)	204	206	208	212	204	206	208	212
NOMINAL CAPACITY	Tons (kW)	3	5	7.5	10	10.5	17.6	26.4	35.1
OPERATING WEIGHT									
Base Unit - 90MA/MF	Pounds (kg)	390	427	895	950	177	194	406	431
Base Unit - 90MU	Pounds (kg)	330	360	835	890	150	163	379	404
Discharge Plenum	Pounds (kg)	25	25	50	50	11.3	11.3	22.7	22.7
COMPRESSOR TYPE		Welded Hermetic Scroll		Semi-Hermetic Reciprocating		Welded Hermetic Scroll		Semi-Hermetic Reciprocating	
Quantity of Cylinders		-	-	4	6	-	-	4	6
Quantity of Unloading Cylinders		-	-	0	2	-	-	0	2
Quantity of Capacity Steps		-	-	1	2	-	-	1	2
DISCHARGE PRESSURE SWITCH									
Opens - 90MA/MF	psig (kPa)	395±10				2725±69			
Closes - 90MA/MF	psig (kPa)	295±20				2034±138			
Opens - 90MU	psig (kPa)	426±7				2937±48			
Closes - 90MU	psig (kPa)	320±20				2206±138			
SUCTION PRESSURE SWITCH									
Opens	psig (kPa)	27±4				186±28			
Closes	psig (kPa)	67±7				462±48			
OPERATING CHARGE - 90MA/MF	pounds (kg)	3.1	5.3	11.2	10	1.4	2.4	5.1	4.5
CONDENSER - 90MA/MF									
Number & Type		1....Tube In Tube							
Water Volume	gallon (liter)	0.39	0.86	2.42		1.48	3.3	9.2	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60 Hz							
Nominal Flow	cfm (m ³ /h)	1200	2000	3000	4000	1698	2830	4245	5660
Standard Speed Range	RPM	525-750	647-915	495-700	600-850	427-652	593-762	412-583	500-708
Maximum Allowable RPM		1050							
Belt Quantity / Pulley Pitch Diameter	inches (cm)	1 / 8.0	1 / 6.4	1 / 8.5	1 / 7.0	1 / 20.3	1 / 16.3	1 / 21.6	1 / 17.8
Motor Pulley Pitch Diameter Range	inches (cm)	2.4 to 3.4				6.1 to 8.6			
Motor Nominal Rating(@60 Hz)...Frame Size									
Standard	horse power	1/3...56	3/4...56	1...56	2...56	.25 / 56	.56 / 56	.75 / 56	1.5 / 56
Alternate (See Note 1)	horse power	3/4...56	1...56	2...56	3...56	.56 / 56	.75 / 56	1.5 / 56	2.2 / 56
Alternate (See Note 1)	horse power	--	--	3...56	--	--	--	2.2 / 56	--
EVAPORATOR COIL		3/8 (.95 cm) OD, Copper Tubes, Aluminum Fins							
Tube Type		Prime							
Quantity of Rows...fin Spacing	fins/inch(cm)	2...14.4	3...14.4	3...12.5		2...5.7	3...5.7	3...4.9	
Face Area	sq ft (sq m)	5	5	7.3	8.5	0.46	0.46	0.68	0.79
RETURN AIR FILTERS		Factory Supplied, Cleanable							
Quantity...Size	inches (cm)	2...16 x 25 x 1		4...16 x 20 x 1		2...40.6x63.5x2.5		4...40.6x50.8x2.5	
CONDENSER CONNECTIONS									
Water Inlet (bottom) & Outlet (top)	inches FPT	1/2	3/4	1	1	1/2	3/4	1	1
Maximum Working Pressure (refrigerant side)	psig (kPa)	400				2758			
CONDENSATE DRAIN CONNECTIONS	inches FPT	3/4				3/4			
ACCESSORY HEATING COILS									
HOT WATER									
Quantity of Rows...fin spacing	fins/inch(cm)	1...15	1...15	2...14	2...14	1...5.9	1...5.9	2...5.5	2...5.5
Face Area	sq ft (m)	5	5	6	6	0.46	0.46	0.56	0.56
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	7/8 ODF		1-1/4 MPT		7/8 ODF		1-1/4 MPT	
STEAM									
Quantity of Rows...fin spacing	fins/inch(cm)	See Note 2		1...14	1...14	See Note 2		1...5.5	1...5.5
Face Area	sq ft (m)	See Note 2		6.9	6.9	See Note 2		0.64	0.64
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	See Note 2		1-1/4 MPT		See Note 2		1-1/4 MPT	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors and drives other than those furnished with unit must be purchased separately. Contact your Carrier Transicold representative.
2. Accessory heating coil in 004 and 006 units is combination hot water/steam. See hot water data.

Table 2 90MA/MF/MU Physical Data - Refrigerant 407C

		R-407C - English Units				R-407C - Metric Units			
BASE UNIT 90MA/MF/MU	UNITS English (Metric)	404	406	408	412	404	406	408	412
NOMINAL CAPACITY	Tons (kW)	3	5	7.5	10	10.5	17.6	26.4	35.1
OPERATING WEIGHT									
Base Unit - 90MA/MF	Pounds (kg)	390	427	895	950	177	194	406	431
Base Unit - 90MU	Pounds (kg)	330	360	835	890	150	163	379	404
Discharge Plenum	Pounds (kg)	25	25	50	50	11.3	11.3	22.7	22.7
COMPRESSOR TYPE		Welded Hermetic Scroll		Semi-Hermetic Reciprocating		Welded Hermetic Scroll		Semi-Hermetic Reciprocating	
Quantity of Cylinders		-	-	4	6	-	-	4	6
Quantity of Unloading Cylinders		-	-	0	2	-	-	0	2
Quantity of Capacity Steps		-	-	1	2	-	-	1	2
DISCHARGE PRESSURE SWITCH									
Opens - 90MA/MF	psig (kPa)	395±10				2725±69			
Closes - 90MA/MF	psig (kPa)	295±20				2034±138			
Opens - 90MU	psig (kPa)	426±7				2937±48			
Closes - 90MU	psig (kPa)	320±20				2206±138			
SUCTION PRESSURE SWITCH									
Opens	psig (kPa)	27±4				186±28			
Closes	psig (kPa)	67±7				462±48			
OPERATING CHARGE - 90MA/MF	pounds (kg)	3.1	5.3	11.2	10.0	1.4	2.4	5.1	4.5
CONDENSER - 90MA/MF									
Number & Type		1...Tube In Tube							
Water Volume	gallon (liter)	0.39	0.86	2.42		1.48	3.3	9.2	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60 Hz							
Nominal Flow	cfm (m ³ /h)	1200	2000	3000	4000	1698	2830	4245	5660
Standard Speed Range	RPM	525-750	647-915	495-700	600-850	427-652	593-762	412-583	500-708
Maximum Allowable RPM		1050							
Belt Quantity / Pulley Pitch Diameter	inches (cm)	1 / 8.0	1 / 6.4	1 / 8.5	1 / 7.0	1 / 20.3	1 / 16.3	1 / 21.6	1 / 17.8
Motor Pulley Pitch Diameter Range	inches (cm)	2.4 to 3.4				6.1 to 8.6			
Motor Nominal Rating(@60 Hz)...Frame Size									
Standard	horse power	1/3...56	3/4...56	1...56	2...56	.25 / 56	.56 / 56	.75 / 56	1.5 / 56
Alternate (See Note 1)	horse power	3/4...56	1...56	2...56	3...56	.56 / 56	.75 / 56	1.5 / 56	2.2 / 56
Alternate (See Note 1)	horse power	--	--	3...56	--	--	--	2.2 / 56	--
EVAPORATOR COIL									
3/8 OD, Copper Tubes, Aluminum Fins									
Tube Type		Prime				Prime			
Quantity of Rows...fin Spacing	fins/inch(cm)	2...14.4	3...14.4	3...12.5		2...5.7	3...5.7	3...4.9	
Face Area	sq ft (sq m)	5	5	7.3	8.5	0.46	0.46	0.68	0.79
RETURN AIR FILTERS									
Factory Supplied, Cleanable									
Quantity...Size	inches (cm)	2...16 x 25 x 1		4...16 x 20 x 1		2...40.6x63.5x2.5		4...40.6x50.8x2.5	
CONDENSER CONNECTIONS									
Water Inlet (bottom) & Outlet (top)	inches FPT	1/2	3/4	1	1	1/2	3/4	1	1
Maximum Working Pressure (refrigerant side)	psig (kPa)	400				2758			
CONDENSATE DRAIN CONNECTIONS	inches FPT	3/4				3/4			
ACCESSORY HEATING COILS									
HOT WATER									
Quantity of Rows...fin spacing	fins/inch(cm)	1...15	1...15	2...14	2...14	1...5.9	1...5.9	2...5.5	2...5.5
Face Area	sq ft (m)	5	5	6	6	0.46	0.46	0.56	0.56
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	7/8 ODF		1-1/4 MPT		7/8 ODF		1-1/4 MPT	
STEAM									
Quantity of Rows...fin spacing	fins/inch(cm)	See Note 2		1...14	1...14	See Note 2		1...5.5	1...5.5
Face Area	sq ft (m)	See Note 2		6.9	6.9	See Note 2		0.64	0.64
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	See Note 2		1-1/4 MPT		See Note 2		1-1/4 MPT	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors and drives other than those furnished with unit must be purchased separately. Contact your Carrier Transicold representative.
2. Accessory heating coil in 004 and 006 units is combination hot water/steam. See hot water data.

Table 3 90MA/MF Physical Data - Refrigerant 134a

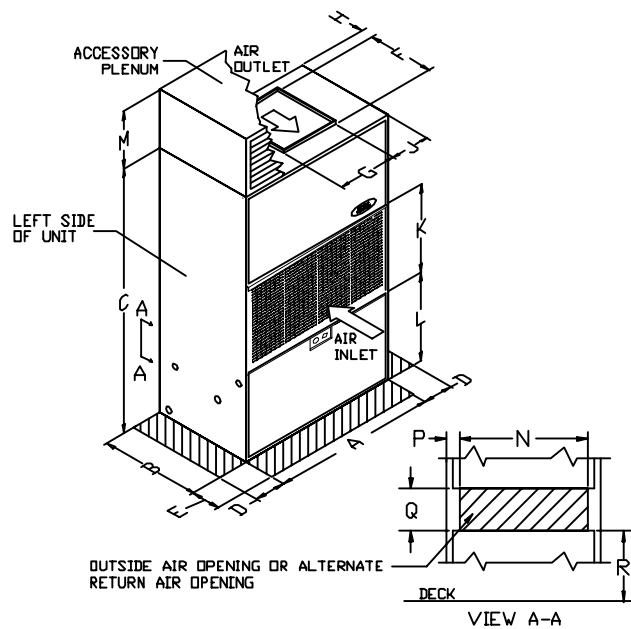
		R-134a - English Units		R-134a - Metric Units	
BASE UNIT 90MA/MF	UNITS English (Metric)	308	312	308	312
NOMINAL CAPACITY	Tons (kW)	5.5	8	19.3	28.1
OPERATING WEIGHT					
Base Unit	Pounds (kg)	895	950	406	431
Discharge Plenum	Pounds (kg)	50	50	22.7	22.7
COMPRESSOR TYPE - Reciprocating		Semi-Hermetic		Semi-Hermetic	
Quantity of Cylinders		4	6	4	6
Quantity of Unloading Cylinders		0	2	0	2
Quantity of Capacity Steps		1	2	1	2
DISCHARGE PRESSURE SWITCH					
Opens	psig (kPa)	335±10		2310±69	
Closes	psig (kPa)	235±20		1620±138	
SUCTION PRESSURE SWITCH					
Opens	psig (kPa)	7±3		48±21	
Closes	psig (kPa)	22±5		152±35	
OPERATING CHARGE	pounds (kg)	11.2	10	5.1	4.5
CONDENSER					
Number & Type		1...Tube In Tube		1...Tube In Tube	
Water Volume	gallon (liter)	2.42		9.2	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60 Hz			
Nominal Flow	cfm (m ³ /h)	3000	4000	4245	5660
Standard Speed Range	RPM	495-700	600-850	412-583	500-708
Maximum Allowable RPM		1050			
Belt Quantity / Pulley Pitch Diameter	inches (cm)	1 / 8.5	1 / 7.0	1 / 21.6	1 / 17.8
Motor Pulley Pitch Diameter Range	inches (cm)	2.4 to 3.4		6.1 to 8.6	
Motor Nominal Rating(@60 Hz)...Frame Size					
Standard	horse power	1...56	2...56	.75 / 56	1.5 / 56
Alternate (See Note 1)	horse power	2...56	3...56	1.5 / 56	2.2 / 56
Alternate (See Note 1)	horse power	3...56	--	2.2 / 56	--
EVAPORATOR COIL		3/8 OD(0.95) cm, Copper Tubes, Aluminum Fins			
Tube Type		Prime			
Quantity of Rows...fin Spacing	fins/inch(cm)	3...12.5		3...14.9	
Face Area	sq ft (sq m)	7.3	8.5	0.68	0.79
RETURN AIR FILTERS		Factory Supplied, Cleanable			
Quantity...Size	inches (cm)	4...16 x 20 x 1		4...40.6 x 50.8 x 2.5	
CONDENSER CONNECTIONS					
Water Inlet (bottom) & Outlet (top)	inches FPT	1	1	1	1
Maximum Working Pressure (refrigerant side)	psig (kPa)	400		2758	
CONDENSATE DRAIN CONNECTIONS	inches FPT	3/4		3/4	
ACCESSORY HEATING COILS					
HOT WATER					
Quantity of Rows...fin spacing	fins/inch(cm)	2...14	2...14	2...5.5	2...5.5
Face Area	sq ft (m)	6	6	0.56	0.56
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	1-1/4 MPT		1-1/4 MPT	
STEAM					
Quantity of Rows...fin spacing	fins/inch(cm)	1...14	1...14	1...5.5	1...5.5
Face Area	sq ft (m)	6.9	6.9	0.64	0.64
Water Inlet (top) & Outlet Connection (bottom)	inches (cm)	1-1/4 MPT		1-1/4 MPT	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors and drives other than those furnished with unit must be purchased separately. Contact your Carrier Transicold representative.



UNIT	004	006	008,012
A	36.19(919)		48(1219)
B	21.88(556)		29.62(752)
C	59.12(1501)		69.50(1765)
D	SEE NOTE 2		
E	24(610)		
F	13.81(351)	16.44(418)	19.38(492)
G	13.13(333)	15(381)	17.25(438)
H	0.75(19)	0.75(19)	1.31(33)
J	12.5(318)	10.62(270)	11.44(291)
K	17.06(433)		23.25(591)
L	20.50(521)		25.37(644)
M	17(432)		17(432)
N	31.88(810)		42.62(1083)
P	2.06(52)		3(76)
Q	10(254)		12.50(318)
R	15.56(395)		16(406)

NOTES:

1. Certified dimension drawings available upon request
2. Minimum required clearance at back of unit is zero. Clearance above and at right (90MA008,012 only) and at left of unit depends on space required for accessory plenum, ductwork, condenser piping, accessory heater piping, condensate drain line and power wiring
3. Water connections are located on left side of unit (Refer to "Make Condenser Connections", Condensate drain connections are located on left side of unit for 004 & 006, and on both sides of unit for 008 & 012.

Figure 2 Unit Dimensions

b. Attach a one-inch (2.5 cm) flange or attach a flanged, flexible duct connection directly to unit.

If an outdoor makeup air damper is to be installed, attach it directly to unit back panel and install flexible connection between damper and remaining ductwork. Use accepted ductwork installation procedures. Follow all applicable codes.

c. Completely blank off the standard return-air opening with a field-fabricated filler panel. The panel must be removable for service access. Refer to paragraph 5.1.

3.9 Check Return-Air Filters

Ensure filters shipped with unit are in place. Never operate unit without return air filters in place.

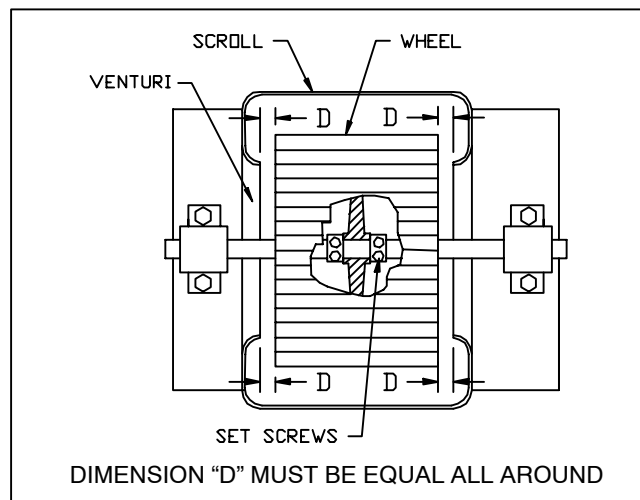


Figure 3 Horizontal Wheel Centering

3.10 Align Fan Shaft and Wheel

HORIZONTAL WHEEL CENTERING - All wheels must be horizontally centered between the inside edges of their fan scroll venturi (Figure 3). Adjust as follows:

- a. Loosen set screws holding wheel to shaft.
- b. Center the wheel by sliding it horizontally.
- c. Re-tighten set screws.

CONCENTRIC ALIGNMENT - Shaft and wheels must be concentrically centered with the venturi (Figure 4). Shaft bearings are supported by bearing supports. If shaft and wheels are concentrically misaligned from shipping shock, it is possible to re-bend bearing support arms to original positions. Replace the bearing support if it has been extensively damaged during shipping.

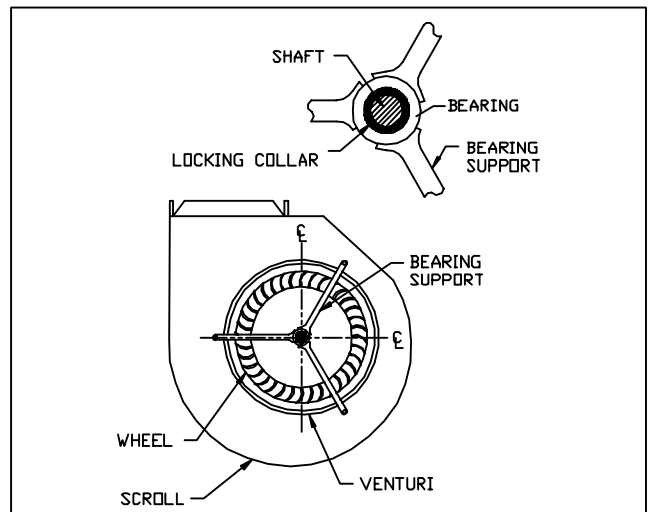
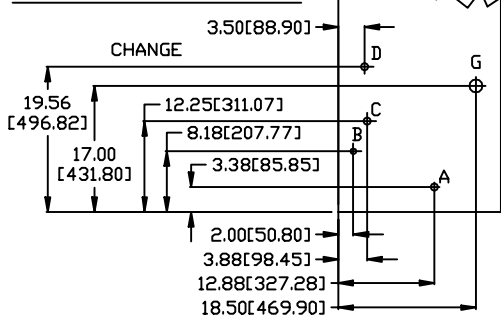
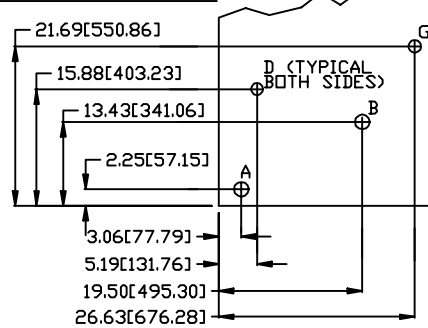


Figure 4 Concentric Wheel Alignment

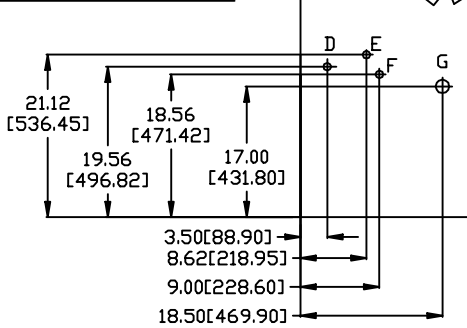
90MA/MF004/006 UNITS



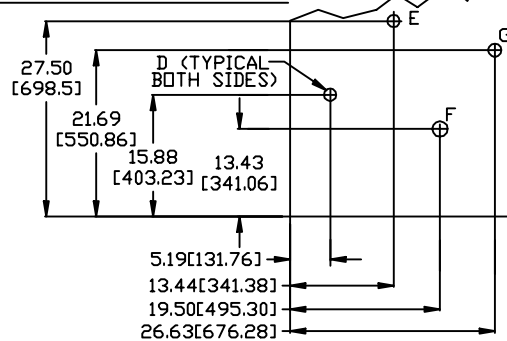
90MA/MU008/012 UNITS



90MU004/006 UNITS



90MU008/012 UNITS



UNIT	A*	B*	C*	D*	E	F	G
90MA/MF004	1/2	1/2	--	3/4 FPT	--	--	1.75 (45)
90MA/MF006	3/4	--	3/4		--	--	
90MA/MF008/012	1"	1"	--		--	--	
90MU004	--	--	--		1/2 flare	1/2 flare	
90MU006	--	--	--	1/2 flare	1/2 flare		
90MU008/012	--	--	--	5/8 O.D.	3/4 O.D.		

* A = Condenser In, B & C = Condenser Out, D = Condensate, all Female Pipe Thread, E = Liquid Refrigerant (field cut), F = Refrigerant Discharge (field cut), G = Electrical Opening

Figure 5 Connection Locations

3.11 Check Compressor Spring Mounts (008 & 012 size only)

The compressors are held rigid in shipment by bolts extending through a washer, grommet and compressor foot into a weld nut. Loosen each bolt (4 per compressor) until compressor floats freely on springs. Then re-tighten bolts until there is slight pressure on the neoprene gasket. This will steady the compressor and prevent start and stop rocking.

The compressors have reversible oil pumps that operate in either direction; therefore, the direction of rotation need not be checked.

3.12 Make Condenser Connections

UNIT MOUNTED CONDENSER (90MA/MF) - Condenser water inlet and outlet connections are shown in Figure 5. Piping arrangements for condenser cooling water are shown in Figure 6.

Connect condenser water supply and return lines as indicated. When connecting water lines, hold the condenser inlet and outlet stubs firmly with a wrench at the female pipe thread hex fitting to prevent twisting. Do not use water lines smaller than connection sizes shown in Figure 5. Observe all applicable plumbing and sanitary codes.

Install water-regulating valve in water supply line outside cabinet as follows.

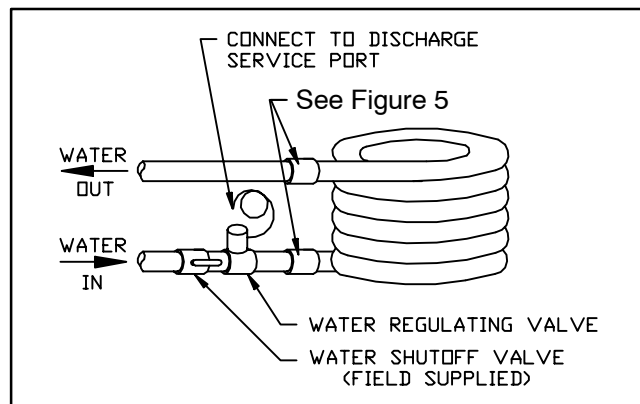


Figure 6 Typical Condenser Water Piping

- Route regulating valve capillary with its flare nut to the port on refrigerant discharge line (Figure 1), using any convenient unused opening on side of unit. Use a grommet in panel to prevent chafing of capillary.
- Remove cap from discharge line fitting.
- Remove cotter pin taped to discharge line fitting. Insert pin, split end first, into regulating valve flare.

Table 4 Recommended Line Sizes, Remote Condenser

UNIT (90MU)	LENGTH OF RUN							
	0-25		26-50		51-75		76-100	
	DISCH	LIQUID	DISCH	LIQUID	DISCH	LIQUID	DISCH	LIQUID
004	1/2 (1.3)	1/2(1.3)	5/8(1.6)	1/2(1.3)	5/8(1.6)	1/2(1.3)	7/8(2.2)	1/2(1.3)
006	5/8(1.6)	1/2(1.3)	7/8(2.2)	1/2(1.3)	7/8(2.2)	1/2(1.3)	7/8(2.2)	1/2(1.3)
008	7/8(2.2)	5/8(1.6)	7/8(2.2)	5/8(1.6)	7/8(2.2)	5/8(1.6)	1-1/8(2.9)	5/8(1.6)
012	7/8(2.2)	5/8(1.6)	1-1/8(2.9)	5/8(1.6)	1-1/8(2.9)	5/8(1.6)	1-1/8(2.9)	5/8(1.6)

NOTES:

1. Line sizes given in inches (cm).
2. Line sizes should never be smaller than cooling unit connection size.
3. A nominal number of fittings has been considered in determining line sizes. Smaller line sizes may be considered if run is simple and few fittings are used.

d. Hold flare tightly against fitting while connecting flare nut. Round end of cotter pin will depress core of fitting. The opened fitting allows refrigerant pressure to act on water regulating valve. Tighten nut to prevent leakage. Fitting automatically seals when nut is removed.

REMOTE MOUNTED CONDENSER (90MU) - Install remote mounted condenser in accordance with the installation instructions provided with condenser. Connection locations for liquid and discharge lines are shown in Figure 5. Recommended line sizes are given in Table 4. Additional instructions can be found in Carrier System Design Manual, Part 3, for standard refrigeration piping techniques. On 008 and 012 size units, secure discharge line to bracket at unit outlet using proper clamp from supplied fastener package

Condenserless (90MU) units are shipped with a refrigerant holding charge. After refrigerant connections are made, leak test, reclaim refrigerant, evacuate, and charge system as described in paragraph 5.9.

3.13 Install Condensate Drain Line

Install a trapped condensate drain line at unit drain connection. The drain requires standard pipe connected to condensate pan nipple(s). Figure 7 shows proper trap design.

Determine design negative static pressure. This pressure is not the same as fan total static pressure, which includes pressure losses downstream as well as upstream from the evaporator air fan. Always assume the worst conditions, such as having return air filters clogged with debris.

Referring to Figure 7, differential 1 must be equal to or larger than negative static pressure at design operating condition. Store enough water in trap to prevent losing seal. Differential 2 must be equal to or larger than one-half the maximum negative static pressure. To avoid loss of seal when the fan starts, differential 3 must be greater than the maximum negative static pressure.

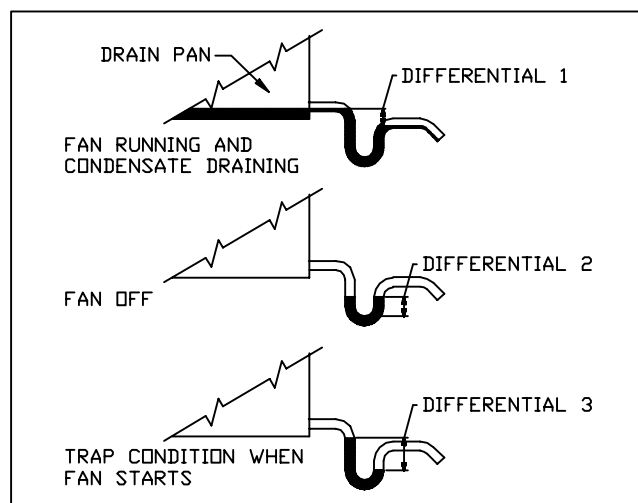


Figure 7 Condensate Drain Trap

Do not use drain line smaller than 3/4 inch. Use hole(s) provided in panel for drain line. Pitch drain line downward toward scupper. Installation of a plugged tee is recommended for cleaning. Fill trap with water to make an air seal. Observe all sanitary requirements.

3.14 Make Electrical Connections

GENERAL - Provide an adequate fused disconnect switch within sight of the unit. Provision for locking switch open (OFF) is advisable to prevent power from being turned on when unit is being serviced.

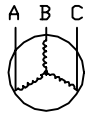
POWER WIRING - Conduit opening for all units is on left side of unit near control box. Connect field power wires at the compressor contactor.

Supply voltage must be in accordance with nameplate voltage. Voltage between phases must be balanced within 2% and current within 10% with compressor running. Correct improper voltage or phase imbalance. Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and shall void the Carrier warranty. Use the following formula to determine the percent voltage imbalance.

DETERMINE PERCENT OF VOLTAGE IMBALANCE

$$\% = 100 \times \frac{\text{MAX DEVIATION FROM AVERAGE VOLTAGE}}{\text{AVERAGE VOLTAGE}}$$

EXAMPLE: SUPPLY VOLTAGE IS 460-3-60 AND
AB = 452v BC = 464v AC = 455v



$$\begin{aligned} \text{AVERAGE VOLTAGE} &= \frac{425 + 464 + 455}{3} \\ &= \frac{1371}{3} = 457 \end{aligned}$$

DETERMINE MAXIMUM DEVIATION FROM
AVERAGE VOLTAGE

$$\langle \text{AB} \rangle 457 - 452 = 5\text{v}$$

$$\langle \text{BC} \rangle 464 - 457 = 7\text{v}$$

$$\langle \text{AC} \rangle 457 - 455 = 2\text{v}$$

MAXIMUM DEVIATION IS 7 VOLTS.

DETERMINE PERCENT OF IMBALANCE:

$$\% = 100 \times \frac{7}{457} = 1.53\%$$

THIS AMOUNT OF PHASE IMBALANCE IS SATISFACTORY
AS IT IS BELOW THE MAXIMUM ALLOWABLE 2 PERCENT.

CONTROL WIRING - On extended voltage (208/230-v) units, the control transformer is factory wired for 208-v usage. If unit is to be used on 230-v system, reconnect primary wiring on transformer. See Figure 13 (004/006 size) or Figure 15 (008/012 size).

On all units, the thermostat is factory installed. A sensing element is provided in the return air. To wire these units to a remote thermostat, or to a remote control switch and thermostat, refer to unit Wiring Diagram or contact your Carrier Transicold representative.

4. OPERATION

CAUTION

Compressor crankcase heater must be energized for 24 hours prior to start up to prevent compressor bearing damage.

4.1 To Start Unit

- Thoroughly inspect exterior of unit. Clean and dust up debris, then wash with mild soap and water solution.
- On 008 & 012 size units, ensure compressor discharge, suction and liquid service valves are open. The valves are accessible from the front of the unit. To open valve, turn counterclockwise. After opening, replace and tighten valve cap to prevent leakage.

Check oil level in compressor sight glass. If level is below glass, add oil to bring level to approximately 1/4 glass. If level is above bottom of glass, do not remove any oil until the crankcase heater has been energized for at least twenty-four hours.

- With selector switch in OFF position, turn main power on. Leave power on for 24 hours so that crankcase heater can drive off accumulated refrigerant.
- If desired, the selector switch may be placed in the FAN position during the crankcase warm-up period. On first start-up, check fan speed (Table 1 through Table 2) and rotation (Figure 1). If fan requires adjustment, refer to paragraph 5.3.

- Allow crankcase heater to remain energized (unit power on) for at least 24 hours. Open any valves in condenser cooling water supply lines and then set selector switch at COOL position. If room temperature is above thermostat setting compressor will start. On first start-up, set water regulating valve. (Refer to paragraph 5.7.)

- Set thermostat for comfort as desired.

4.2 To Shut Down Unit

- Turn selector switch to OFF position. Do not shut off main power except to service unit. The crankcase heater is operative only when main power is on. (Refer to paragraph 5.12).
- If unit is to be used for winter heating, set selector switch at HEAT position and re-set thermostat at desired setting.
- If unit may be exposed to freezing temperatures, drain water from condenser and water piping. Add a non-corrosive antifreeze to residual water in system.

4.3 Sequence Of Operation

Unit operation is dependent on the position of the mode selector switch. (See note 3, Figure 14 or Figure 16.) Operation sequence for each switch position is provided in the following paragraphs.

OFF POSITION: With correct voltage supplied at the field power supply terminals, see Figure 13 or Figure 15 power flows through normally closed crankcase heater relay (CHR) contacts (CHR, 4/5) to energize the crankcase heater (CH).

TO PLACE THE UNIT IN THE FAN MODE: The switch (SW) is placed in the FAN position to supply 24 volt control power, to energize indoor fan contactor (IFC). Energizing IFC closes contacts (IFC, 11/21, 12/22 & 13/23) to energize the motor. Operation of the crankcase heater is maintained.

TO PLACE THE UNIT IN THE COOL MODE: The switch (SW) is placed in the COOL position. With thermostat (T-LOW) calling for cooling (closed to contacts R & W) control power flows from TRAN through T-LOW, SW and compressor lockout (CL) normally closed contacts to the discharge pressure switch (DPS). On 008/012 size units, flow continues through the compressor internal protector (IPC), compressor overloads (OLA & OLB) and the suction pressure switch (SPS), to energize CHR. On 004/006 size units, flow continues directly through the suction pressure switch to energize CHR.

Energizing CHR opens contacts CHR 4-5 to de-energize CH and closes contacts CHR 1-3 and energize the compressor contactor (CC). Energizing CC closes its contacts to start the compressor motor (C). Operation of the indoor fan motor (IFM) is maintained.

On 90MU units, power also flows from terminal TB1-5 to energize condenser fan relay (CFR). Energizing CFR closes its contacts to supply power to the field supplied condenser fan relay.

012 size units are fitted with a two stage cooling system. On these units, if thermostat switch T-HIGH is also calling for cooling, power flows through thermostat

switch T-HIGH to energize liquid line solenoid (LLS) [to activate the full evaporator coil and all compressor cylinders]. If thermostat switch T-HIGH is not calling for cooling, power flows to energize compressor unloader solenoid (US) [to unload compressor cylinders].

When room temperature falls to the cutout point of T-LOW, switch T-LOW opens to de-energize CHR, stopping the compressor motor and energizing CH. The machine enters a stand-by state, ready to restart automatically on room thermostat call for cooling.

If any safety device opens (CLO, SPS, DPS, IP, OLA or, OLB) relay CHR is de-energized, stopping the compressor motor and energizing the crankcase heater.

TO PLACE THE UNIT IN THE HEAT MODE: The switch (SW) is placed in the HEAT position. With thermostat (T-LOW) calling for heating (closed to contacts R & B), 24 volt control power flows through manual reset temperature cutout MC to energize safety relay H2. Power also flows through air flow switch (AS) and automatic cutout (AC) to energize operating relay (H1). Energizing relays H1 and H2 closes contacts to energize the heaters.

Placing SW in the FAN position de-energizes all cooling or heating control circuits in the same manner as activation of a safety switch. Placing SW in the OFF position also de-energizes IFC to stop the indoor fan motor.

5. SERVICE

WARNING

Never reach into unit while fan is running. Lock open and tag unit disconnect before working on fan. Remove fuses and take them with you after noting this on tag.

CAUTION

Sharp edges of coil fins are exposed. To prevent injury, cover top of evaporator with cardboard or a few layers of heavy tape.

CAUTION

To avoid coil damage, cover evaporator face with plywood or other rigid sheet material. If any coil fins are mashed or bent, straighten with a coil fin comb of the proper tooth spacing (refer to "coil fins/inch" in Table 1 through Table 2). Check for refrigerant leaks.

5.1 Return-Air Grille Removal

- Pull grille out from top.
- Pull grille up to release hinge pins from lower panel.
- To reassemble, reverse procedure.

5.2 Access Panel Removal

- Remove return-air grille as described above.
- Remove the panel fastening screws now exposed.
- Pull out and down to remove top panel.
- Pull out and up to remove bottom panel.

5.3 Evaporator Fan Adjustment

WARNING

Never reach into unit while fan is running. Lock open and tag unit disconnect before working on fan. Remove fuses and take them with you after noting this on tag.

SPEED ADJUSTMENT - The fan motor pulleys are factory set at the fan speeds listed in Table 1, Table 3 or Table 2. to change fan speed, do the following:

- Shut off unit power supply.
- Loosen fan belt by loosening fan motor from mounting bracket. Do not loosen fan motor mounting bracket from unit.
- Loosen movable pulley flange set screw (Figure 8).
- Screw movable flange toward fixed flange to increase fan speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum allowable fan speed or motor full load amps indicated on motor nameplate.
- Set movable flange set screw at nearest flat of pulley hub and tighten set screw.
- Check pulley alignment and belt tension adjustment as described below.
- Check fan operation. Repeat above procedure as required.

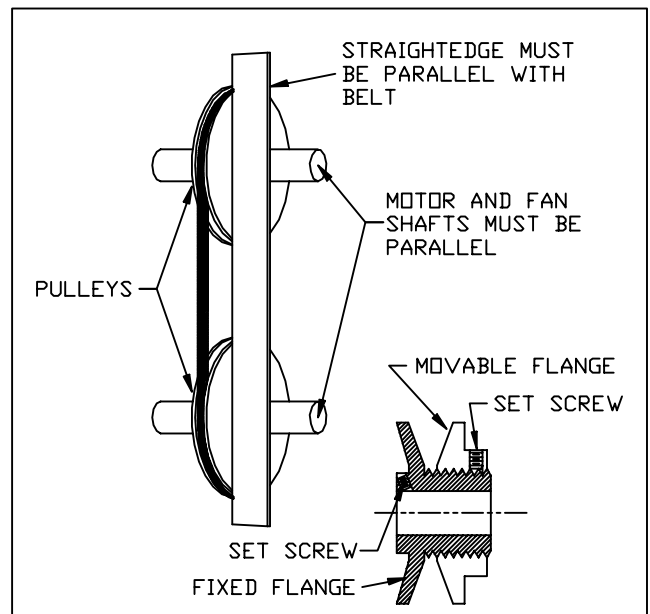


Figure 8 Fan Pulley Adjustment

PULLEY ALIGNMENT - Shut off unit power supply. Loosen fan motor pulley set screws and slide fan pulley along fan shaft. Make angular alignment by loosening motor from mounting bracket (See Figure 8).

BELT TENSION ADJUSTMENT - Shut off unit power supply. Loosen fan motor from mounting bracket. Do not loosen motor mounting bracket from unit. Move fan motor up or down until proper belt tension is achieved (approximately 3/4-in. deflection with 8-pound tension at midpoint of belt span).

Lubrication - Fan motor and fan shaft bearings are lubricated for the life of the bearings. No re-lubrication is required

5.4 Return-Air Filter

Inspect filters twice monthly and clean as required by operating conditions. Filter size and type are listed in Table 1, Table 3 or Table 2. To clean filters flush with hot water or steam or soak in a mild water solution of soap or detergent. Refer to filter manufacturer's instructions as applicable. Do not operate unit without return-air filters in place.

5.5 Condensate Drain

Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled as shown in Figure 7 to maintain an air seal.

5.6 Evaporator Coil

WARNING

Never reach into unit while fan is running. Lock open and tag unit disconnect before working on fan. Remove fuses and take them with you after noting this on tag.

Remove dirt and debris from evaporator coil as required by condition. Clean coil with a stiff brush, vacuum cleaner or compressed air. Use a fin comb of the correct tooth spacing (Refer to Table 1, Table 3 or Table 2 for coil fins/inch) when straightening mashed or bent coil fins.

5.7 Water Regulating Valve

PREPARATION FOR OPERATION.

- Open the water regulating valve inlet and outlet isolation valves.
- Close the water regulating valve bypass valve.

ADJUSTMENT

- The compressor discharge pressure is controlled by the water regulating valve and may be monitored by observing liquid line pressure.

NOTE

Adjustments to the water regulating valve must be made slowly, allowing ample time for response and stabilization.

- Install a calibrated gauge at the liquid line service port. Operating liquid line range for R-22 units is 250 to 270 psig (1724 to 1862 kPa), for R-134a units is 155 to 180 psig (1069 to 1241 kPa) and for R-407C is 267 to 288 psig (1841 to 1986 kPa). If pressure reading is below operating range, rotate the square head adjusting screw counterclockwise; this will increase

spring tension, decrease water flow and increase pressure.

If pressure reading is above operating range, rotate the square head adjusting screw clockwise; this will decrease spring tension, increase water flow and decrease pressure.

- Only the water regulating valve opening point is adjustable. The closing point is 3 to 7 psig below the opening point and is non-adjustable.

5.8 Condenser

Condensers may require cleaning of water-deposited scale.

WARNING

Follow all Safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, attack concrete and, without inhibitor, can attack steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

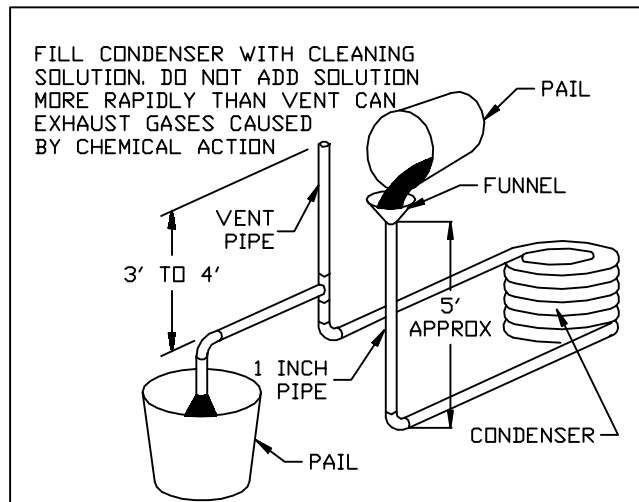


Figure 9 Gravity Flow Method

GRAVITY FLOW METHOD

- Disconnect condenser piping at unit, including isolation valves and water regulating valve.
- Fill condenser as shown in Figure 9. Follow acid manufacturer's instructions. When condenser is full, allow solution to remain overnight
- Drain condenser and flush with clean water.

FORCED CIRCULATION METHOD

- Disconnect condenser piping at unit, including isolation valves and water regulating valve.
- Fill system as shown in Figure 10. Follow acid manufacturer's instructions. Fully open vent pipe when filling system. The vent may be closed when system is full and pump is operating.

- c. Regulate flow to condenser with a supply line valve. If pump is a non-overloading type, the valve may be fully closed while pump is running. For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours.
- d. Drain condenser and flush with clean water.

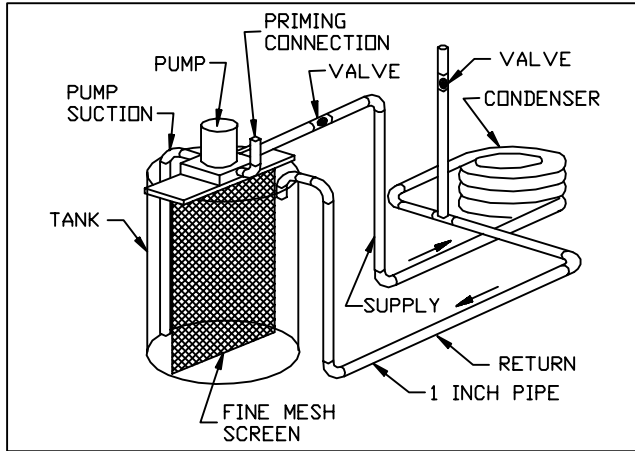


Figure 10 Forced Circulation Method

5.9 Refrigerant Charging

90MA/MF - These units are shipped with a full operating charge. If recharging is necessary (complete charge lost), weigh in amount of refrigerant indicated on unit nameplate and in Table 1, Table 3 or Table 2.

If unit has partial charge, it must be recharged by removing existing charge and recharging by weighing in the required amount of refrigerant.

90MU004 & 006 - These units, used with remote condensers, are shipped with a holding charge only. To charge:

- a. Open discharge and liquid service valves.
- b. Leak test, reclaim refrigerant and evacuate.
- c. Using standard refrigerant charging techniques and charging charts (Figure 11) add refrigerant as required to maintain proper operating conditions.

90MU008 & 012 - These units, used with remote condensers, are shipped with a holding charge only. To charge:

- a. Open discharge line, liquid line, compressor discharge and compressor suction service valves.
- b. Leak test, reclaim refrigerant and evacuate.
- c. Add sufficient refrigerant vapor to permit continuous operation after starting unit.
- d. Start unit. Using standard charging techniques, add refrigerant as required to maintain normal operating conditions. Use charging chart supplied with condenser, if available. If information is not available, block off enough of condenser or set water regulating valve as applicable to maintain a discharge pressure of 220 psig (1517 kPa) for R-22 units or 233 psig

(1607 kPa) for R-407C units. Charge to a clear sight glass.

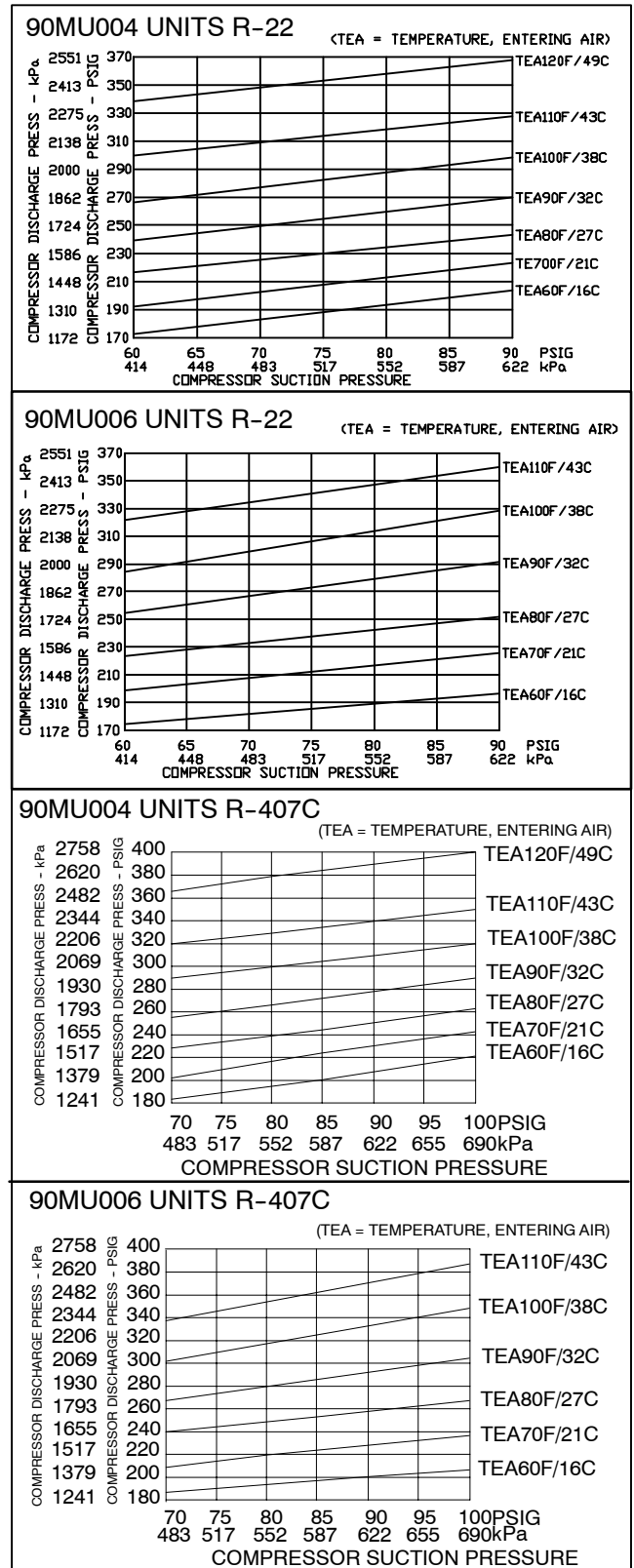


Figure 11 Charging Charts

5.10 Evaporator Fan Motor Removal

- a. Shut off unit main power supply.

WARNING

Lock open and tag unit disconnect before working on fan motor. Remove fuses and take them with you after noting this on tag.

CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

- b. Loosen motor hold down bolts on mounting bracket so that fan belt can be removed. Motor power wires need not be disconnected from motor terminals before motor is removed from unit.
- c. Loosen but do not remove the 2 motor mounting bracket bolts on left side of bracket.
- d. Slide motor/bracket assembly to extreme right, remove bolts and lift out through space between fan scroll and side. Rest motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

5.11 Pressure Relief Device

All units are equipped with a fusible-plug type safety relief device on the refrigerant tubing. The relief setting is 197 °F to 203 °F on all units.

5.12 Crankcase Heater

A crankcase heater is supplied on the 008 & 012 size units and on all 134a units. The heater prevents liquid refrigerant from accumulating in the compressor crankcase during extended shutdown periods. Heater is automatically energized whenever unit main power is on and compressor is stopped. Heater is de-energized when compressor starts.

Do not shut off main power supply for an extended period except for servicing unit. Turn on power supply for at least 24 hours after an extended shutdown before starting compressor. Refer to "Operation".

5.13 Cycle-Loc™ - Protection Device

All units are equipped with Cycle-LOC current-sensing lockout relay. This device will lock out the compressor after any safety trip (discharge pressure switch, suction-pressure switch, or internal overload of the compressor). Check reason for lockout before resetting the device. Refer to unit label wiring diagram. To reset, turn the system switch to OFF, then back to COOL.

5.14 Discharge and Suction Pressure Switches

Refer to Table 1 through Table 2 for opening and closing settings for these safety devices.

The discharge pressure switch is located on the compressor on the 008 & 012 size units and on the discharge line on all other units. The suction pressure switch is located on top of the compressor on 06DR compressor equipped units and on the suction line on all other units.

5.15 Oil Charge

All units are factory charged with oil. On 06D compressors, observe the oil level in the sight glass at start-up. If unit oil level is below sight glass, add oil until level reaches approximately 1/4 sight glass.

If oil charge is above sight glass, do not remove any oil until the compressor crankcase heater has been energized for at least 24 hours.

When additional oil or a complete charge is required, use only the following Carrier approved oil.

R-22 Units

Design Series One 204/206 size units

Witco part number 999-5170-55

Design Series One 208/212 size units and all Design Series Two

Witco - Suniso 3GS

Calumet - RO-15

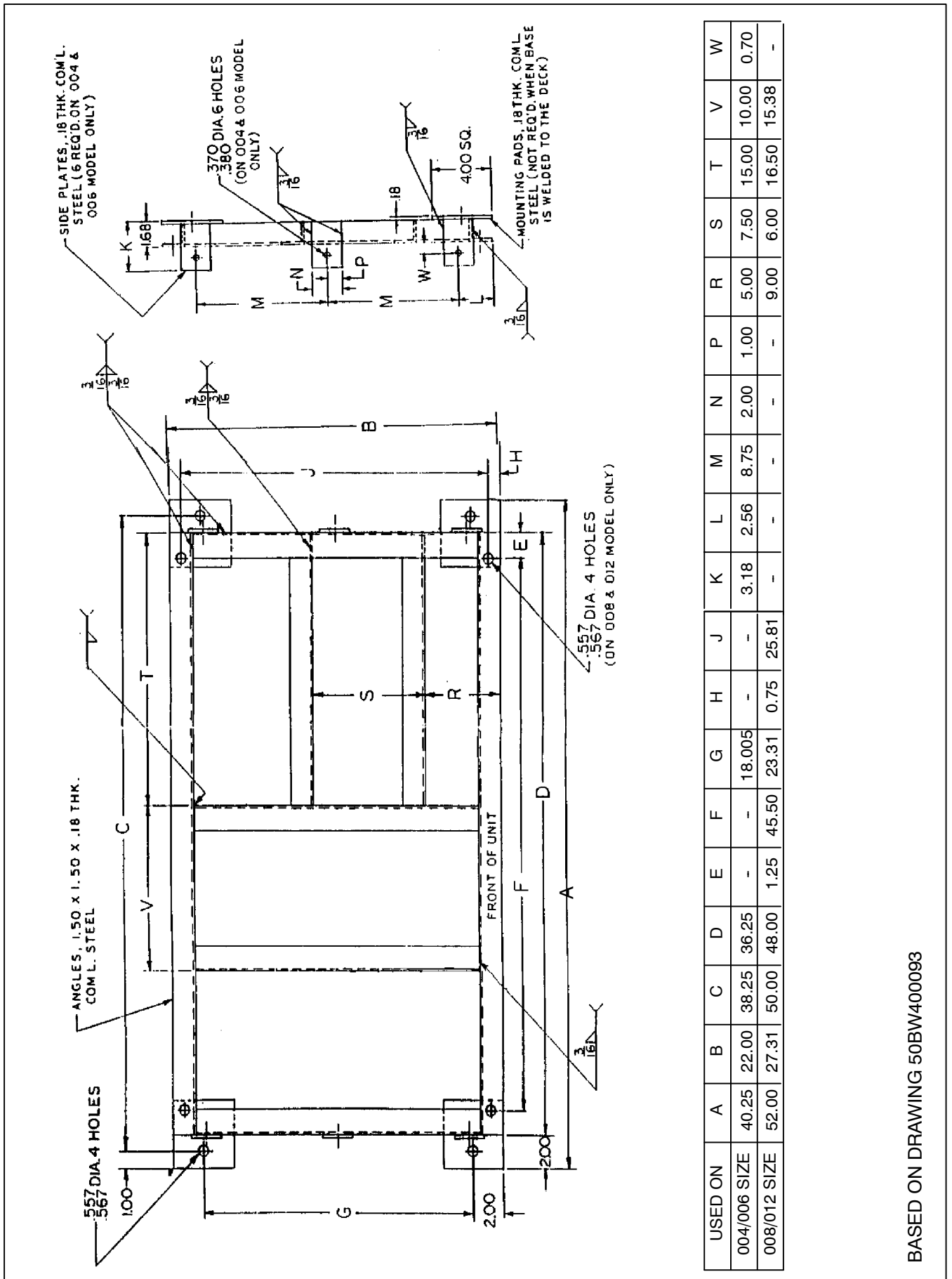
R-134a Units

Castrol - Icematic E68

ICI - Emkarate RL68HP

R-407C Units

004 and 006	Copeland Ultra 22CC Mobil Artic EAL 22CC ICI (Virginia KMP) Emkarate RL32C Thermal Zone 22CC
008 and 012	Castrol - Icematic E68 ICI - Emkarate RL68HP



USED ON	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	V	W
004/006 SIZE	40.25	22.00	38.25	36.25	-	-	18.005	-	-	3.18	2.56	8.75	2.00	1.00	5.00	7.50	15.00	10.00	0.70
008/012 SIZE	52.00	27.31	50.00	48.00	1.25	45.50	23.31	0.75	25.81	-	-	-	-	-	9.00	6.00	16.50	15.38	-

Figure 12 Mounting Base

BASED ON DRAWING 50BW400093

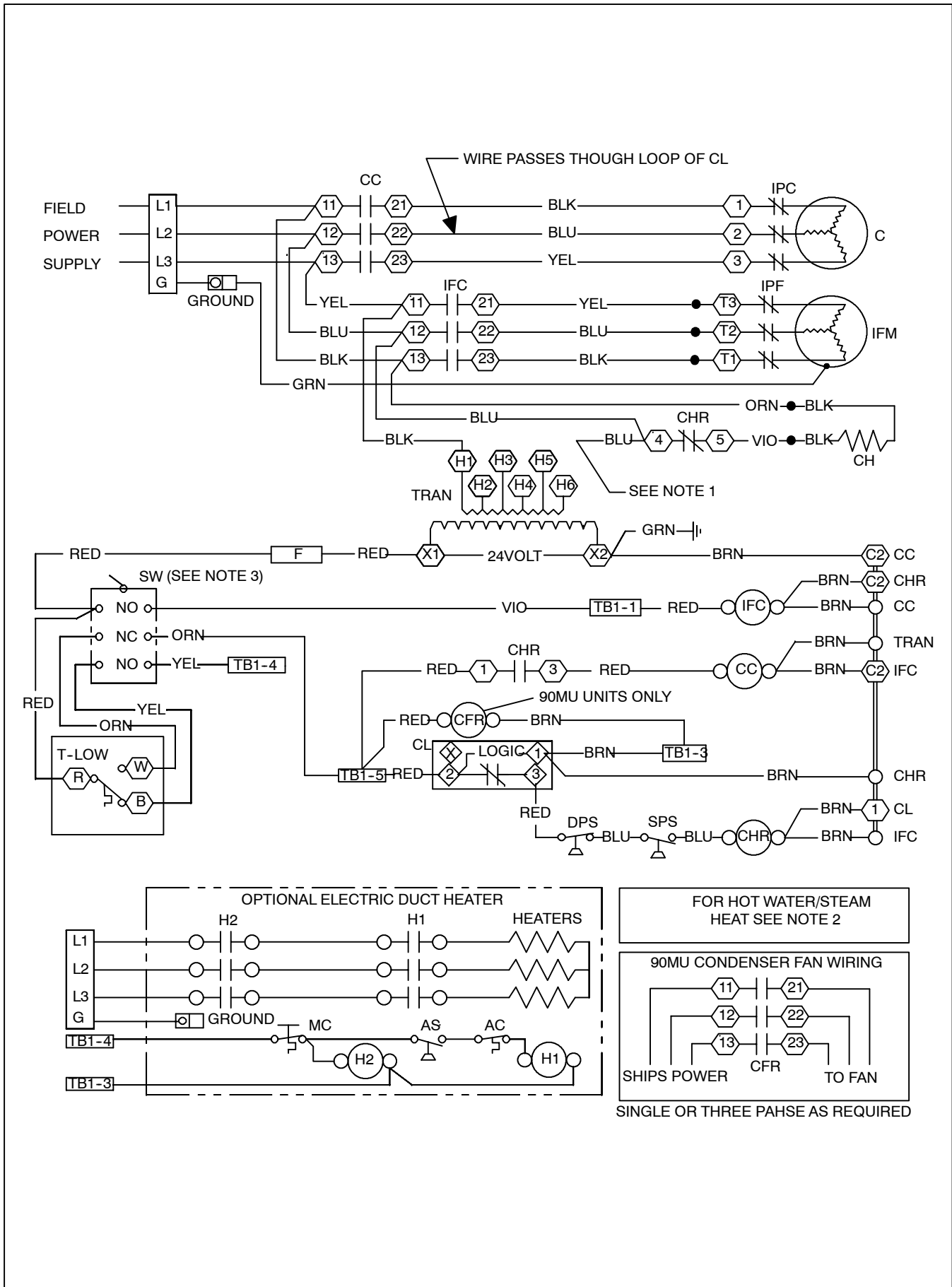
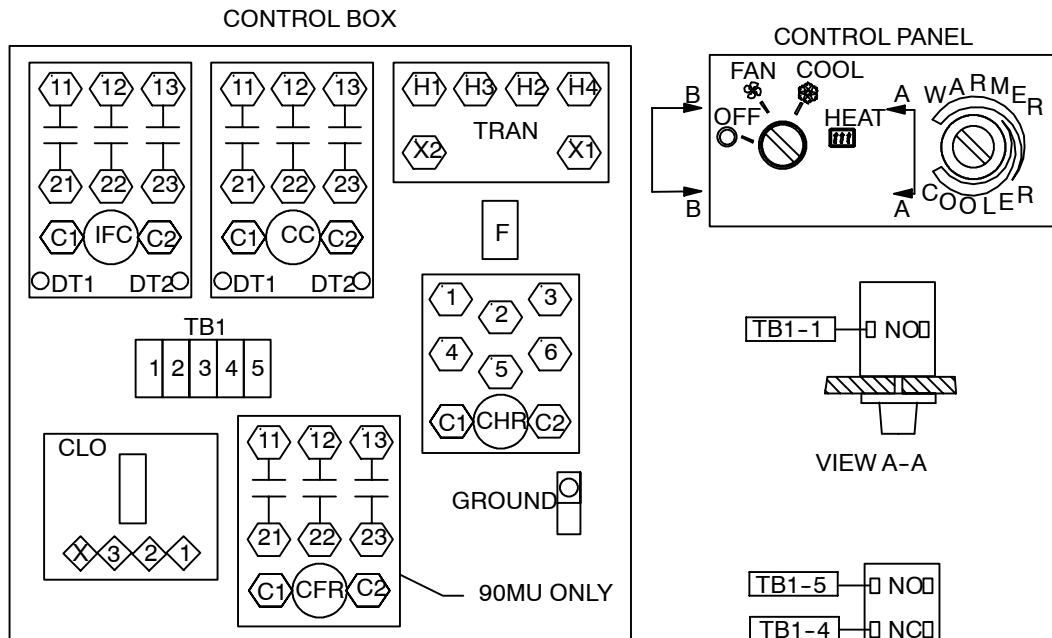


Figure 13 Wiring Schematic - 90MA/MF/MU004/006



LEGEND

- AS AIR SWITCH
 - AC AUTOMATIC CUTOUT
 - C COMPRESSOR
 - CC COMPRESSOR CONTACTOR
 - CH CRANKCASE HEATER
 - CFR CONDENSER FAN RELAY
 - CHR CRANKCASE HEATER RELAY
 - CL COMPRESSOR LOCKOUT
 - DPS DISCHARGE PRESSURE SWITCH
 - F FUSE
 - H1 CONTROLLING HEAT CONTACTOR
 - H2 BACKUP HEAT CONTACTOR
 - IFC INDOOR FAN CONTACTOR
 - IFM INDOOR FAN MOTOR
 - IPC INTERNAL PROTECTOR-COMPRESSOR
 - IPF INTERNAL PROTECTOR-FAN MOTOR
 - MC MANUAL (RESET) CUTOUT
 - SPS SUCTION PRESSURE SWITCH
 - SW SWITCH
 - T THERMOSTAT
 - TB TERMINAL BOARD
 - TRAN TRANSFORMER
-
- TERMINAL BOARD TERMINAL
 - TERMINAL (MARKED)
 - TERMINAL/SPLICE (UNMARKED)
 - LOCKOUT TERMINAL
 - FACTORY WIRING
 - FIELD WIRING
 - INDICATES COMMON POTENTIAL, DOES NOT REPRESENT WIRING

NOTES:

1. 208-230/3/60 VOLT UNITS FACTORY WIRED TO TRANSFORMER TERMINAL H2 (208 VOLT TAP). FOR 230 VOLT APPLICATIONS, RE-CONNECT TO TERMINAL H3 (230 VOLT TAP).
- 460/3/60 VOLT UNITS FACTORY WIRED TO TERMINAL H6. 400/3/50 VOLT UNITS FACTORY WIRED TO TERMINAL H5.
2. CONNECTION POINTS AT TB-1 TERMINALS 3 & 4 MAY BE USED FOR HEAT CONTROLS. MAXIMUM LOAD IS 250 VA INRUSH, 50 VA SEALED.
3. SWITCH CONTACT ARRANGEMENT IS AS SHOWN BELOW.

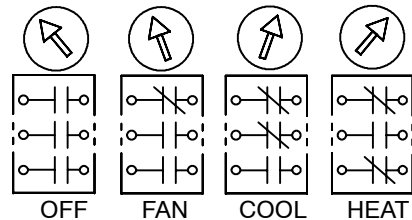


Figure 14 Component Arrangement - 90MA/MF/MU004/006

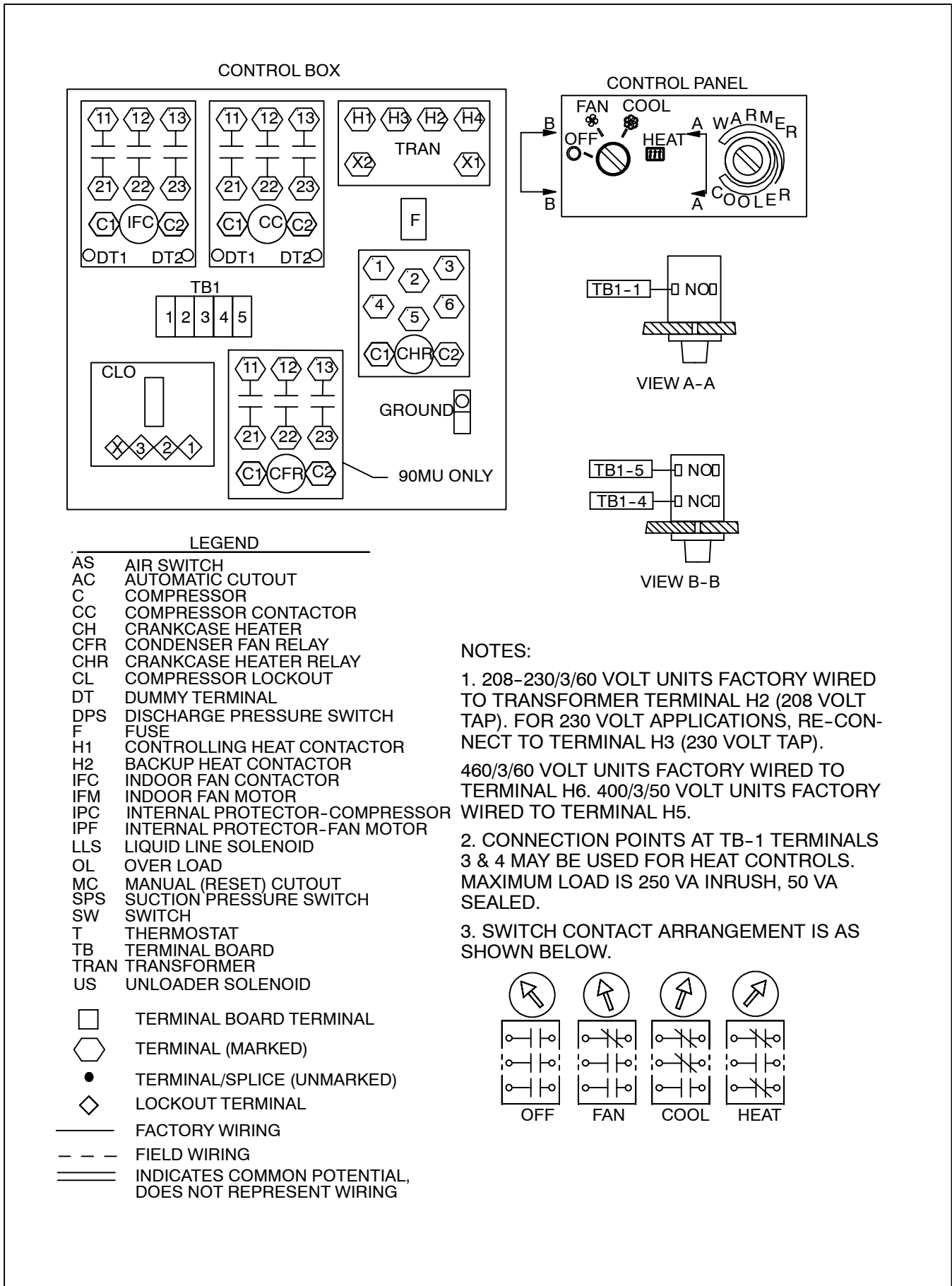


Figure 16 Component Arrangement - 90MA/MF/MU008/012

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